Progress in BRAHMS

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The p + p measurements at RHIC provide both a baseline measurement for the R_{AA}, information of the Single Spin Asymmetry using the polarization information from RHIC, as well as information on the soft physics of p + p collisions. Our analysis of BRAHMS data at the Cyclotron Institute in the past year has concerned generating transverse momentum (p_t) hadron spectra resulting from p + p collisions at $\sqrt{s_{nn}} = 200$ GeV in order to analyze the yields of produced particles.

An example of the spectra we have generated is shown in Fig. 1 where we show proton and anti-proton spectra. The points represent the data. The spectra range from mid-rapidity to y~3.5 as noted in the legend. Each spectrum is divided by a successive factor of 10 except for the break between

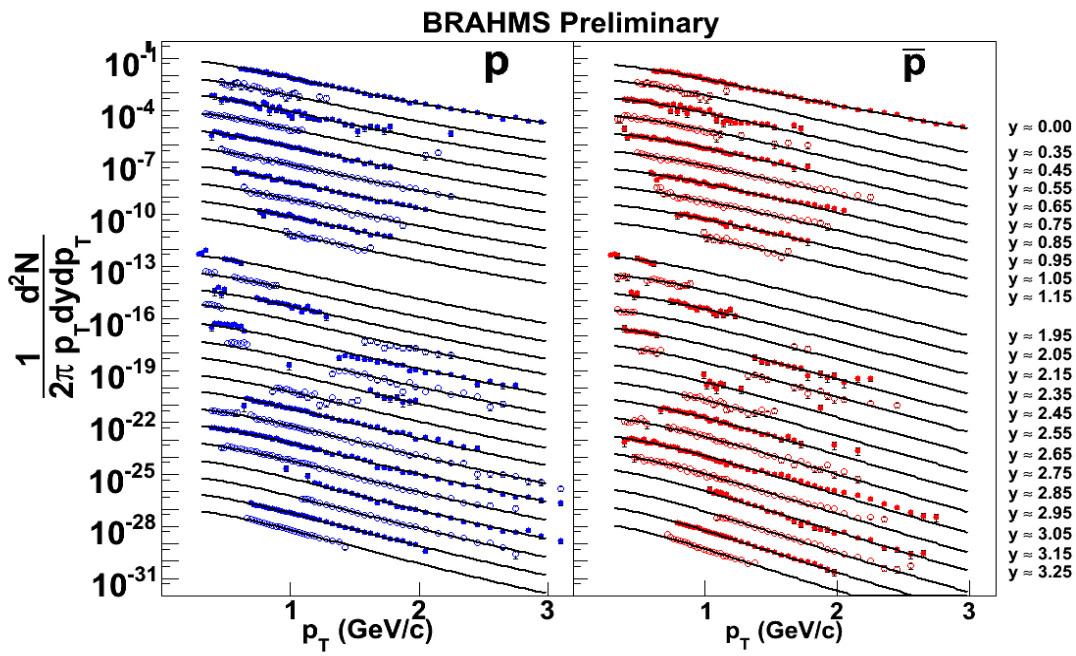

Figure 1. Proton and anti-proton p_t spectra from mid-rapidity to y~3.5. The lines indicate the results of a global fit to a Levy function.

measurements with the mid-rapidity spectrometer and the forward spectrometer where there is a factor of 100 between them.

The solid lines represent fits to the data with a Levy function given by:

$$\frac{1}{2\pi p_T}\frac{d^2N}{dydp_T} = \frac{1}{2\pi}\frac{dN}{dy}\frac{(n-1)(n-2)}{nT\left(nT+m_0(n-2)\right)}\left(1+\frac{(m_T-m_0)}{nT}\right)^{-n}$$

where $m_T^2 = m_0^2 + p_T^2$, and dN/dy, n and T are parameters. A global fit was performed over the entire rapidity range using $T = T_0 + ay + a_2y^2$, $n = n_0 + by + b_2y^2$ where the fitting parameters are dN/dy, T_0, a, a_2, n_0, b, b_2.

An interesting quantity used to study baryon transport is nuclear stopping. The BRAHMS collaboration has published information on stopping for Au + Au at $\sqrt{s_{nn}} = 200\,\text{GeV}$ [1]. We have started a similar analysis where we examine the net – proton distributions obtained from subtracting the

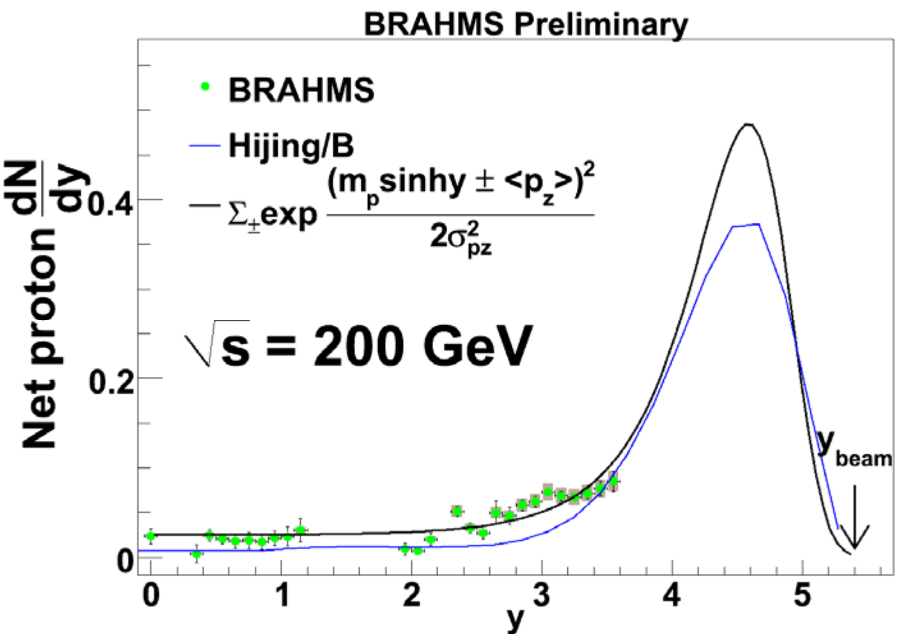

Figure 2. Net proton dN/dy. The blue curve indicates the prediction of Hijing/B and the black curve represents a fit to a symmetric sum of two Gaussians in momentum space.

proton and anti-proton dN/dy parameters from the fits. In principle $<\delta y>$ should be calculated using the net-baryon distribution. However, the corrections from net-proton to net-baryon are expected to be relatively constant over the rapidity range that we have measured. The net-proton dN/dy is shown in figure 2 where the green points represent the data. We note a relatively flat distribution from mid-rapidity to y~2 and then a slight increase. In fact, we do not, as we did not in Au + Au [1], measure the bulk of the yield. We do, however, have significant information because of baryon conservation. The Hijing/B calculation (also shown in Fig. 2) indicates a net proton integral of about 0.6 in the forward region. The Hijing/B calculation indicates an average proton transport of $<\delta y> \sim 1.2$. Allowing Hijing/B to guide us, we make a fit to a Bjorken inspired symmetric sum of two Gaussians in momentum space [2] constraining the area under the curve to be 0.6. Such a fit results in a mean momentum of 46 GeV/c with a spread of 17 GeV/c. The black curve shown in Fig. 1 shows the result of the fit and the resultant parameters indicate $<\delta y> \sim 1.5$.

We plan to complete this analysis of this data in the coming months and publish the results of this interesting study.

[1] I. G. Bearden *et al.*, Phys. Rev. Lett. **93**, 102301 (2004).
[2] J. D. Bjorken, Phys. Rev. D **27**, 140 (1983).